

ARIZONA
DEPARTMENT OF TRANSPORTATION

STANDARD SPECIFICATIONS

for

ROAD AND BRIDGE
CONSTRUCTION



2008

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31-066

SECTION 501 PIPE CULVERT AND STORM DRAINS:**501-1 Description:**

The work under this section shall consist of furnishing pipe and all other materials required and the installing of pipe, including excavating, and furnishing, placing and compacting backfill material, all in accordance with the details shown on the plans and the requirements of these specifications.

At each location where a pipe is to be installed, the project plans will specify the size and approximate length along with the requirements for each approved option at that location, such as the wall thickness, corrugation configuration, coatings, linings, class and strength.

At each such specified location, pipe of one kind and material shall be selected by the contractor from the options shown. All contiguous pipe and all metal pipe in close proximity shall be of the same kind and material. Special sections, fittings, elbows, branch connections, tapered inlets, end sections, connectors, coupling, and other such items shall be of the same material and coating as the pipe to which they are attached unless otherwise stated in these specifications.

When trenching to depths in excess of five feet is required, prior to construction the contractor shall submit in writing to the Engineer a detailed description of its proposed trenching operations, including shoring methods.

501-2 Materials:**501-2.01 All Pipe Except Nonreinforced, Cast-In-Place:**

Except for nonreinforced, cast-in-place concrete pipe, materials shall conform to the requirements of Section 1010.

501-2.02 Nonreinforced, Cast-In-Place:

Concrete for constructing the cast-in-place concrete pipe shall conform to the requirements of Section 1006 for Class S concrete, except as specified herein.

Class S concrete shall have a minimum compressive strength of 3,000 pounds per square inch at 28 days.

The proposed slump in the mix design furnished by the contractor shall be the minimum required to permit proper placement of the concrete without harmful segregation, bleeding or incomplete consolidation.

The maximum size of the coarse aggregate for pipes 48 inches or less in diameter shall be one inch and for pipes larger than 48 inches in diameter shall be 1-1/2 inches.

501-3 Construction Requirements:**501-3.01 Preparation of Foundations, Trenches, and Embankments:**

A trench condition is defined as a trench which has vertical slopes to a point at least one foot above the top of the pipe and its maximum width is as detailed on the plans.

Unless specified otherwise, the contractor may install pipe in either a non-trench condition or a trench condition in natural ground or in embankment.

Where rock, hardpan, or other unyielding material is encountered, such material shall be removed below the vertical limits as shown on the plans. The depth to be removed shall be at least 12 inches or as designated by the Engineer. The width to be removed shall depend on whether a trench or non-trench condition exists. If a trench condition exists, the width of the trench as shown on the plans shall be maintained throughout the additional depth. If a non-trench condition exists, the width of the removal shall be a minimum of the outside diameter of the pipe plus two feet for pipe under four feet in diameter, or a minimum of the outside diameter of the pipe plus three feet for pipe of four or more feet in diameter. The overexcavated area shall be backfilled with structure backfill material as designated in Subsection 203-5.03(B)(1) and compacted in layers not exceeding six inches in depth.

When a firm foundation is not encountered at the bottom of the vertical limits as shown on the plans due to soft, spongy, or other unstable soil, such unstable soil shall be removed for a width of at least the horizontal outside dimension of the pipe on each side of the pipe and to the depth specified by the Engineer. The unstable soil removed shall be replaced with structure backfill material as designated in Subsection 203-5.03(B)(1) and compacted in six-inch lifts.

The completed foundation shall be firm for its full length and width. When specified on the project plans, the foundation shall have a longitudinal camber of the magnitude specified.

501-3.02 Bedding:**(A) Bedding Material:****(1) General:**

Bedding material for all pipe shall conform to the following aggregate gradation:

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Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	90 - 100
No. 8	35 - 80
No. 200	0 - 8.0

The plasticity index of the bedding material for all pipe shall not exceed 8 when tested in accordance with the requirements of AASHTO T 90.

Bedding material for all pipe shall have a value of resistivity not less than 2,000 ohm-centimeters unless otherwise specified or approved by the Engineer. Bedding material shall have a pH value between 6.0 and 10.0, inclusive, for all metal pipe installations except aluminum. Bedding material for aluminum pipe installations shall have a pH value between 6.0 and 9.0, inclusive. Bedding material shall have a pH value between 6.0 and 12.0, inclusive, for all concrete or plastic pipe installations. Tests for pH and resistivity shall be in accordance with the requirements of Arizona Test Method 236.

(2) Standard Aggregate Bedding Material:

Standard aggregate bedding material shall conform to the requirements specified in Subsection 501-3.02(A)(1) and may be compacted, jetted, or placed as an aggregate slurry as herein specified.

The maximum water content in an aggregate slurry mixture shall be 35 gallons of water per ton of bedding material. Unless otherwise approved by the Engineer, the slurry shall be compacted with internal vibrators in accordance with the requirements of Subsection 601-3.03(D). Aggregate slurry shall be thoroughly mixed in a mixer approved by the Engineer.

(3) Cement-Treated Slurry Bedding Material:

Aggregate for cement-treated slurry bedding material, prior to the addition of cement and water, shall conform to the requirements specified in Subsection 501-3.02(A)(1). One sack of cement shall be added to each cubic yard of aggregate. Cement-treated slurry shall be thoroughly mixed in a mixer or at a central batch plant as approved by the Engineer and shall have a slump of eight to 11 inches.

(B) Placement of Bedding Material:

(1) General:

All trash, forms, sheeting, bracing, and loose rock or loose earth shall be removed from the area into which bedding material is to be placed.

Bedding material shall be placed under and around the pipe from the bottom of the trench or bedding limits to the elevation at the point of maximum width of the pipe (springline), as shown on the plans. At the

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contractor's option, bedding material may be placed above the springline of the pipe, at no additional cost to the Department.

For pipes placed in a non-trench condition, as shown on the plans, standard aggregate bedding material shall be used from six inches below the pipe to the springline.

For pipes placed in trench condition, a six-inch layer of standard aggregate bedding material shall be placed, in accordance with the plans, between the bottom of the trench and the bottom of the pipe. The remainder of the bedding, from the bottom of the pipe to the springline, shall be either standard aggregate bedding material or cement-treated slurry as tabulated below:

For pipe culverts or storm drains 36 inches or larger, cement-treated slurry shall be used as bedding material from the bottom of the pipe to springline.

For pipe culverts or storm drains less than 36 inches in diameter, cement-treated slurry may be substituted for standard aggregate bedding material from the bottom of the pipe to springline.

Bedding material shall be placed in a manner which will prevent distortion, damage to, or displacement of the pipe from its intended location. Bedding material shall also be placed so that adequate support will be provided in the haunch support areas for the pipe. Voids or loose soils which are found to occur due to improper placement or compaction of bedding materials will result in rejection of that portion of the pipe installation. Replacement of the pipe will be at no additional cost to the Department.

(2) Standard Aggregate Bedding Material:

Standard aggregate bedding material shall be placed either in uniform horizontal layers not exceeding eight inches in depth before compaction or in uniform horizontal layers not exceeding four feet in depth when placed as a slurry. Bedding material may also be placed in uniform horizontal layers not exceeding four feet in depth when compaction is done by jetting.

(3) Cement-Treated Slurry Bedding Material:

Cement-treated slurry bedding material shall be placed in a uniform manner that will prevent voids in, or segregation of, the bedding material, and will not float or shift the culvert or pipe. Cement-treated slurry bedding material shall be placed from bottom of pipe to pipe springline. No backfilling above the cement-treated slurry shall be commenced until 24 hours after the cement-treated slurry has been placed.

(C) Compaction of Bedding Material:

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and with a plasticity index of at least 10 and shall be placed as shown on the plans. The plasticity index will be determined in accordance with the requirements of AASHTO T 90.

(B) Placement of Backfill Material:

(1) General:

All trash, forms, sheeting, bracing, and loose rock or loose earth shall be removed from the areas to be backfilled before backfill material is placed.

Backfill compacted by pneumatic or mechanical tamping devices, shall be placed in layers not more than eight inches in depth before compaction.

Pipe backfill shall be brought up evenly on both sides of the pipe for the full length to an elevation one foot above the top of the pipe.

Trench backfill shall be placed from one foot above the top of the pipe to the elevation at which base or surfacing materials are to be placed or to the top of the trench.

Backfill material shall be placed around and over arches in accordance with the requirements of Section 502.

(2) Standard Aggregate Slurry:

Pipe backfill or trench backfill mixed as a standard aggregate slurry shall be placed in uniform horizontal layers not exceeding four feet in depth. The slurry shall be compacted with internal vibrators in accordance with the requirements of Subsection 601-3.03(D).

(3) Cement-Treated Slurry:

Cement-treated slurry pipe backfill placement above springline shall not commence within 24 hours of the placement of the underlying cement-treated bedding material below springline. Cement-treated pipe backfill shall be placed in a uniform manner that will prevent voids in or segregation of the backfill to an elevation one foot above the top of the pipe. No backfilling above the cement-treated slurry pipe backfill shall be commenced until 24 hours after the cement-treated slurry has been placed.

If cement-treated slurry bedding material is used for trench backfill, it shall not be disturbed or loaded in any manner within 24 hours of placement as above.

(C) Compaction of Backfill Material:

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Backfill material shall be compacted to at least 95 percent of the maximum density determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer.

Jetting shall not be used to compact pipe backfill, trench backfill or any material placed more than one foot above the top of the pipe.

Ponding will not be allowed in any case.

If trench backfill or pipe backfill is placed as an aggregate slurry, the contractor shall excavate holes in the compacted slurry to the depths and at the locations designated by the Engineer. These holes shall be of such size as to allow the required density tests to be performed in a safe manner. Upon completion of the tests, the contractor shall refill the excavated areas and compact the material to the required density in a manner satisfactory to the Engineer.

Cement-treated slurry bedding material for pipe backfill shall not require additional compaction after placement up to an elevation one foot above the top of pipe if it meets the material requirements of Subsection 501-3.02(A) and is placed and compacted as outlined in Subsection 501-3.04(B) and (C). No density tests will be required in the cement-treated slurry bedding material when it is utilized for pipe backfill to an elevation one foot above the top of pipe.

Cement-treated slurry bedding material used for trench backfill shall meet the requirements listed above for pipe backfill up to the elevation which it is placed.

501-3.05 Filter Material:

When shown on the project plans or specified in the Special Provisions, filter material shall be carefully placed around perforated pipe.

Filter material shall conform to the grading requirements for fine aggregate in Section 1006 and shall be placed in accordance with the details shown on the project plans.

501-3.06 Encasement of Pipe:

When shown on the project plans, pipe shall be encased in Class B concrete. Portland cement concrete shall conform to the requirements of Section 1006.

501-3.07 Nonreinforced, Cast-In-Place Concrete Pipe:

(A) General Requirements:

The contractor shall have previously installed cast-in-place pipe similar to the pipe specified in this contract. The Engineer may require the